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ABSTRACT

Described is a curriculum theory and construction within an epistemological model whose specific purpose is to serve as a general guide to the Amerindian peoples (Indians and Inuit) in their search for solutions to the problem of cultural survival. The model is also meant to have universal application, especially where there are cultures in conflict. This model can act as a tool of awareness of inter- and intra-cultural dialectics, hence to identifying problems, and to setting up relevant research programs leading to the reshaping of curricula and the reorientation of the other vital forces working to enhance cultural continuity. (Author)

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EPISTEMOLOGY AND THE CURRICULUM : THE BIO-ECOCULTURAL COGNITIVE SPIRAL AS MODEL

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SUMMARY OF TOPICS

Introduction

Evolution

Ontogeny and Phylogeny

Cognitive Theories

Universals and Variants

Symbols and Symboliques or Symbol Systems

Cryptos and Scriptos

Implications and Applications of the Model

Conclusion

To all the children

of the spirals

especially

Amerindians and Inuit

It seems, as one becomes older,
That the past has another pattern, and ceases to be a mere
sequence--
Or even development: the latter a partial fallacy
Encouraged by superficial notions of evolution,
Which becomes, in the popular mind, a means of disowning
the past.
The moments of happiness--not the sense of well-being,
Fruition, fulfilment, security or affection,
Or even a very good dinner, but the sudden illumination--
We had the experience but missed the meaning,
And approach to the meaning restores the experience
In a different form, beyond any meaning
We can assign to happiness. I have said before
That the past experience revived in the meaning
Is not the experience of one life only
But of many generations--not forgetting
Something that is probably quite ineffable:
The backward look behind the assurance
Of recorded history, the backward half-look
Over the shoulder, towards the primitive terror.

T. S. Eliot
Four Quartets

EPISTEMOLOGY AND THE CURRICULUM:

THE BIO-ECOCULTURAL COGNITIVE SPIRAL AS MODEL

Introduction

The objectives of this study are twofold. First, it is meant to imbed curriculum theory and construction within an epistemological model whose specific purpose is to serve as a general guide to the Amerindian peoples (Indians and Inuit) in their search for solutions to the problem of cultural survival. Secondly, the model is meant to have universal application especially where there are cultures in conflict where it can act as a tool to awareness of inter- and intracultural dialectics, hence to identifying problems, to setting up relevant research programs leading to the reshaping of curricula and the reorientation of the other vital forces working to enhance cultural continuity.

First of all, I should like to give a brief definition of the key concepts of the title before elaborating on their meaning in the course of the presentation of my hypothesis. Epistemology deals with the origin and nature of knowledge, its history and development, its modes of transmission, acquisition and creation, and finally, its limits and boundaries. In a word, it is the history of the structuration of cognition, that is, of the structures and functions of the codes and modes of communication of knowledge. Curriculum construction is concerned with the conscious and voluntary selection, analysis and ordering of certain areas of knowledge by specialists for formal transmission by and to particular groups in order to contribute to the continuity, growth and survival of a given cultural community. Just as the building of curricula must be an outgrowth of a theory of curriculum, curriculum theory must find its sources in a general theory of knowledge. It is a basic postulate of this hypothesis that such an epistemological model is rooted in the evolution of the species, more particularly in the evolution of what I call the human ecocultural cognitive spirals, covering the diversity of

what are commonly referred to as cultures. The latter are a ramification of the former, that is, of the evolutionary bio-ecocultural spiral--a graphic image that covers all the spirals of knowledge from the genetic code of the earliest unicellular organism to the multiple symbolic codes of the hypercomplex multicellular organism called man. The bio-ecocultural spiral of spirals that I propose as an epistemological model for curriculum theory and construction revolves evidently around the central metaphor of the spiral, more specifically the complexifying expanding spiral of genetic and symbolic knowledge.

I was first struck by the spiral metaphor in a comment by Jean Piaget in his book on Structuralism to the effect that "...rather than envisaging human knowledge as a pyramid or building of some sort, we should think of it as a spiral the radius of whose turn increases as the spiral rises. This means, in effect," Piaget goes on to say, "that the idea of structure as a system of transformations becomes continuous with that of construction as continual formation." (p.34). A couple of years later in 1972, Jacques Mehler, a leading French psycholinguist made the following reference to the spiral in a paper entitled "On Cognitive Development" at the Royaumont symposium on the general theme -- The Unity of Man: Biological Invariants and Cultural Universals -- and I quote: "To recapitulate certain arguments that I have attempted to present, I shall say that children are born equipped with certain general psychological dispositions. Development would then consist in the application of these dispositions discovering at the same time the different boundary corditions that make them useful. In fact, this would explain the apparent spiral-shaped pattern of cognitive development." (Translation mine, The Unity of Man, Tome 2: The Human Brain, p. 47). In the same book mentioned above, Piaget quotes L. Apostel, according to whom Lēvi-Strauss grants, though grudgingly, that dialectics "substitute "spirals" for the linear or "tree" models...and these famous spirals or non-vicious circles are very much like the genetic circles or interactions characteristic of growth." (p. 125). More significant still is the recurrence of the concept of the spiral throughout Edgar Morin's most recent publication, namely, The Method: The Nature of Nature, the first tome of a trilogy (Tome 2--The Life of Life, Tome 3--The Knowledge of Knowledge) where the French bio-anthropologist attempts to break through the barriers of our contemporary paradigm to explore the application of a new principle of complexity incorporating the contradictory, the paradoxical, the disjunctive and

all that is apparently logically irreconcilable in reality thereby introducing a new paradigm, that is, a new method to interpret the universe. He metaphorizes his quest in the form of a spiral and I might add, the growth of my own hypothesis followed a similar spiral-shaped course. He utilizes the concept of the loop in cybernetics and in information theory as a retroactive/recursive interplay which generates knowledge. Let me quote him in his concluding pages: "The loop is self-generating at the same time as it generates; it is self-producing at the same time as it produces. It is not a vicious circle since it derives its nourishment (data) by observing phenomena, that is, in a phenomenal ecosystem (its écothèque) and because it is animated by the cognitive activity of the thinking subject (its "génothèque"). It is an open loop which closes, and thereby can develop in spiral form, that is, produce knowledge...reality is produced through the loop of interactions that produce organization, through the loop of relations between the object and subject." (Translation mine, p. 381). In the same line of thought, Jacques Lacan, the French Freudian psychoanalyst stresses the hierarchical structuration of the unconscious that his biographer, Anika Lemaire, endorses in these words: "...that signification is born progressively from a permanent dialectic between grouped signifiers and grouped signifieds, rather like spiral loops uniting,..." (Jacques Lacan, p. 15). In a paper on "Brain Mechanisms of Vision" in the September 1979 Scientific American special issue on the brain, Hubel and Wiesel make reference to the following fact: "In the visual cortex there is a hierarchy of neurons with increasingly complex response properties...simpler cells feeding more complex ones." (pp. 154-5). This point of view is further corroborated by Gordon M. Shepherd, in a paper on "Microcircuits in the Nervous System" where he says: "...it is becoming evident that the nervous system is built up of hierarchies of functional units of increasing scope and complexity....At the highest levels of organization such functions as perception, memory, learning and complex behavioral acts call for coordination of many centers. In this coordination a microcircuit and a macrocircuit are not separate entities; one is indissolubly imbedded in the other." (Scientific American, February, 1978, p. 103). Also, one should take note of Bertalanffy's dictum that "...reality is a hierarchy of organized wholes." (Trends in General Systems Theory, p. 38). Last but not least, it should be heavily underscored that the hierarchic structure of the transformational rules that govern the creative process in language as propounded by Chomsky is a central issue in cognitive development. More will be said on the conflicting Chomskyan and Piagetian hypotheses in a later section, also

with reference to the spiral metaphor. All this to suggest that from the microscopic spiral-like double-helix DNA molecule to the macroscopic spiral galaxies, the spiral metaphor with its complexifying hierarchical dynamics of growth seems indeed to pervade the universe.

As will be demonstrated throughout this paper, the spiral is a powerful metaphor because it encapsulates the following concepts that are fundamental to the hypothesis: a growth and decay process, systemicity, dynamicity, interdependence, interaction, generativeness, auto-organization, irreversibility, complexification and hierarchization, the integration of nature and nurture, spirals growing out of spirals within spirals, and finally, the spiral is an open system like living organisms and offers a dynamic geometric figure viewable and analysable diachronically and synchronically.

Knowledge belongs to the biosphere, hence to living organisms. Living systems do not live in a vacuum; they have a place under the sun, a natural habitat, that is, an ecological niche into which they are born, grow and reproduce optimally. All biological systems, individual organisms and species, possess modes of behaviour controlled by a specific set of codes of communication which can be subsumed under the general name of culture. These codes of communication are at once the vehicles and the arsenals of knowledge whose natural habitat is the bio-ecocultural organism in which it is coded and stored in genetically inherited programs of behaviour in the DNA molecule and/or in ecoculturally acquired programs of behaviour operating within the neurosynaptic network of the central nervous system. The perpetual intricate interplay of the biological, ecological and cultural codes operating in cyclical symbiosis from disorder to order, according to von Foerster's celebrated principle--order from noise--or if you prefer, order (organization) from disorder, constitutes the history of life and therefore of knowledge. Indeed, it is by equating the evolution of knowledge with that of life that the bio-ecocultural cognitive spiral becomes relevant as the epistemological model which serves as a metatheory to curriculum theory and construction.

At some point in the process of humanization the species dispersed into different physical environments which generated the diverse cultures of the modern world. Each developed in its own way from a common bio-ecocultural cognitive apparatus in an expanding complexifying spiral-shaped process to meet the demands

of its own specific ecological niche. The evolutionary bio-ecocultural spiral out of which grew the multiple human ecocultural spirals is meant to envelop the dialectics of the struggle for life and the survival of the fittest, a war of the species as it were, before becoming a war of ecocultural spirals (sets of symbol systems) that are at the core of the conflicting human cultures. To put it another way, man was freed from the devastating vagaries of chance that dominate the genetic war when chance set his species on the road to manhood by giving his central nervous system the possibility of developing symbolic thought and language-in-consciousness, or if you prefer, consciousness-in-language. The dynamic metaphor of the spiral offers a generative model of spirals growing out of spirals within spirals representing the billions of species and thousands of human cultures that have come and gone while a fraction of them survived. All these are in one way or another interdependent historically. Furthermore, the three thousand or so surviving human cultures are also tied synchronically by bio-ecocultural universals yet, by their variants are in perpetual conflict for survival as separate and distinct toolkits in a continual war of symboliques (the French equivalent of symbol system) each vying for possession of the central nervous system of all those falling within its sphere of influence.

In support of the concept of the complexifying expanding spiral of genetic and symbolic knowledge it is important to point out that Piaget, himself, in his vision of the spiral had been inspired by the revolutionary theorem by the German mathematician, Kurt Gödel, who in 1931 demonstrated the limits of the formalization of knowledge which tends to corroborate the Piagetian constructivist theory of learning. Gödel's proof illustrated beyond question that it is impossible to demonstrate the non-contradiction of the theory of elementary arithmetic on the basis of its own axioms but that we need to appeal to a stronger and superior theory such as transfinite arithmetic in order to do so. In turn, to establish the non-contradiction of the latter theory, one must construct a more complex and powerful theory, and so on, ad infinitum. In other words, no theory is self-sufficient for its proof; each requires a metatheory for its justification.

This hierarchical ordering of theoretical systems growing one out of another is comparable to the hierarchical and complexifying growth of inanimate and biological systems throughout evolution. As a matter of fact, it supports the

whole process of development from simple to more and more complex forms, to wit: 1) cosmic evolution--from subatomic particles following the birth of the universe, to the atom, to the star, to the solar systems, to the galaxies and clusters of galaxies; 2) biological evolution--from unicellular to multicellular organisms (bacteria to man); 3) psychological development--the learning process from elementary sensori-motor activity of the infant through the iconic stage on to that of language and symbolic thought; 4) sociocultural evolution--from simple to more elaborate codes and modes of communication of knowledge, leading to hypercomplex institutional networks. The evolution of the bio-ecocultural cognitive spiral, as a central metaphor, envelops within itself these processes of development.

Without the evolution of the cosmos there is no sun, without the sun there is no life and without life there is no knowledge. All these processes of growth involve a gradual irreversible complexification of the systems culminating in the hypercomplex human brain with its ten billion or more interacting neurons. The hierarchical complexification of systems characteristic of the evolutionary process, according to Gödel's proof, can only be formally coded in an equally expanding hierarchical complexifying process of theoretical knowledge where each theory validates itself by virtue of a metatheory in an ever expanding continuum which I call the bio-ecocultural spiral of knowledge. In this connection, it is significant to mention another mathematician, Renē Thom, a contemporary, whose revolutionary theory of catastrophes introduces the fundamental notion that all morphogenesis is a process of creation of structures through the breakdown of structures (catastrophes), hence growth, organization and order are inextricably tied to disorganization and disorder. This process is, in fact, a basic principle of evolution where entropy and negative entropy are interlocked in a dialectic that renders life and knowledge possible. Thom's theory also strongly underscores Gödel's idea of the limits of the formalization of knowledge faced by the modern scientific paradigm and Thom, himself, is dreaming of a breakthrough into a new paradigm that might allow the formalization of the presently unformalizable. To his critics who accuse him as a mathematician of too much speculation, he retorts: is the dream not the virtual catastrophe (discontinuity) from which new knowledge can spring? It is important to point out that Thom's theory of catastrophes (the breakdown or discontinuity of structures) supports the theory of structuralism and Piagetian constructivism in that in his view the structure is not given but owes its existence and stability to an underlying dynamic which must give in to a superior force that creates the new structure which in turn breaks down before an antagonistic set

of forces, ad infinitum. Hence, in my view, the bio-ecocultural cognitive spiral forming an intertwining and interdependent triadic set of codes (symbol systems, symboliques) which developed symbiotically from the first stirrings of life in the primeval soup up to modern man can serve as a generative model of hierarchical complexification for the explication of the interacting biological, ecological and cultural codes--the protagonists of the drama of life.

Science, in its broadest sense, is the construction by a subject, man, of explicit codes of knowledge and theories by deciphering what appears to be implicitly coded in the object under study. Most modern scientists are challenging the postulate of classical science which excluded from consideration the structure and dynamics of the observing system from the system observed. The observer, of course, is man but unfortunately that living system remains much of a mystery. The transformation of the hardware of the exact sciences by the observing subject's software, that is, his analytical and descriptive method, the product of his brain, is so significant that it has lead the neurobiologist, Paul D. MacLean to postulate the subjective brain as a fifth dimension of reality. (The Human Brain, pp. 137-8). For example, a formal grammatical description would like to be the explicit code of grammar that everyone learns spontaneously and unconsciously from birth. This is a case of the observing system observing itself and other living systems in possession of a similar code. In any event, in spite of these built-in difficulties, specific grammars will find their best description within the context of a general theory of language whose roots will be universal grammar, itself finding its origins in the genetic evolution of the species.

This study is focussed on the highest form of life in the evolutionary process, that is, homo sapiens; therefore, the reader must expect the conceptual framework of the human ecocultural spirals to be in the foreground while never forgetting its ineradicable bonds of continuity with its ageless bio-ecocultural past. As a matter of fact, it is precisely the symbiotic development of knowledge and life throughout evolution which underscores the need to reintegrate nature with nurture in the curriculum because man is not separate from but continuous within the evolutionary bio-ecocultural spiral. For instance, the model defines human culture as a bio-ecocultural spiral, that is, as a set of closely interdependent interacting symbol systems or symboliques whose natural habitat is the central

nervous system of the members of a given community. More graphically, culture's ecological niche is the billions of billions of interacting neurons of a particular group of central nervous systems that not only share the same basic set of symbol systems but also pursue broadly the same spiral-shaped course. By the same token, the culture of the bee or the ant viewed historically represents each a bio-ecocultural spiral, that is, a network of closely related signal systems (pheromones, etc.) whose ecological niche is the central nervous system of the particular species in question. Each species of bee or ant behaves and perpetuates itself according to a particular set of signals of communication in a particular habitat, hive or anthill. In other words, a bio-ecocultural complex is the inheritance of a particular species whose evolution is viewed through the metaphor of the spiral. In the case of homo sapiens, since only one biological species is concerned (even if the gene pool varies somewhat from one race to another) its multiple physical environments and its different networks of symbol systems are referred to as human ecocultural spirals, which amounts to saying in common parlance, the various cultures of the world. The metaphor of the spiral is also useful because it reveals time and space dimensions, a diachronic axis when viewed historically and a synchronic axis when its dynamic structure is examined at a given point in time.

The human ecocultural spirals being rooted in the evolutionary epic, to use Edward O. Wilson's memorable image, are necessarily tied by universals such as basic sets of cognitive structures, to wit: the faculty of language, the ability to recognize facial characteristics, the capacity to interpret gestures or body language, specific space and sound perceptions and other structures of human intelligence that all serve the human organism to shape his common sense world. All the existing natural languages which we can reasonably infer have a common origin since in the mathematics of genetic mutation and selection opportunity is not likely to knock twice, stand today as a classic example of the variants among human collectivities largely due to environmental factors. It is evident that the Inuit of the Arctic regions cannot have had throughout their history the same ecological preoccupations as the desert peoples. Hunting for the nomads of the far North cannot possibly have the same meaning as a mode of physical survival as it has for desert nomads who have little or nothing to hunt. Water, to use but a single example, as an element of survival carries with it vastly different networks of symbolization for the hunters and gatherers of the Arctic and the nomads of the

African deserts. Both these examples of ecocultural variants represent but a drop in the ocean of differences that exist between one set of symbol systems and another.

Each ecocultural spiral, divergent at the surface structure, is made up of a separate and distinct network of symbol systems or symboliques which is the toolkit for survival of each human collectivity. These symboliques such as verbal and body language, moral and aesthetic value systems, religion, mythology, rituals, music, song and dance, to name only a few of the most obvious, inhabit and thus shape the central nervous system of each individual literally from the womb to the tomb. Recent theories propounded by the French school of bio-anthropologists and the American sociobiologists considerably blur the traditional distinction between inherited and acquired characteristics thus lending support to the inseparability of pre- and postnatal phenomena in the physical and intellectual maturation of the individual. Sociobiology's main thesis or more precisely, its proposed new synthesis between the biological and social sciences, aims at bridging the age-old gap between nature and nurture for its fundamental postulate is that all social behaviour has a biological basis. As Edward O. Wilson, its chief proponent, says in his characteristic imagery: "The genes hold culture on a leash." (On Human Nature, p. 167).

Just as universal grammar, postulated by Chomsky, does not obviate differences in natural languages, the genetic component in human behaviour does not eliminate ecocultural variants. Each human ecocultural spiral constitutes a network of highly integrated symboliques or symbol systems that compete for possession of the central nervous system of the individuals caught up in its dynamics. Even though the symboliques share a common origin in the bio-ecocultural evolutionary spiral, it does not prevent this competition, rather it helps to explain it. The biological and the ecocultural are immutably linked in each species--a fact which makes it impossible for a chimpanzee, howsoever clever, from learning human language spontaneously from simple exposure to linguistic data as a child does under normal conditions; for the same reason, it is equally impossible for chimpanzees to develop religious institutions. The interspecific barriers in cognitive structures that exist between man and the chimpanzee, for instance, do not exist intraspecifically in homo sapiens, therefore, the different sets of human ecocultural symboliques can be learned by anybody, thus explaining the perpetual

state of war among each other.

The fact that the model distinguishes between biological universals and ecocultural variants which at a certain level blend into bio-ecocultural universals or invariants has important implications for curriculum theory and practice. For instance, the individual learner must find out what he or she shares in common with humanity and its non-human ancestors; also, the child must know what distinguishes him or her from other individuals and other cultural collectivities. More particularly, the learner must learn why this is so. For example, noone chooses his genetic blueprint at conception, nor the ecological niche into which he is born nor the cultural toolkit that structures his central nervous system. It is essential for an individual to understand that he is not responsible for the uniqueness of his personality owing to the triple lottery--genetic, ecological and cultural--in order to respond favourably to the delicate process of self-acceptance and behaviour modification in harmony with his group dynamics. In a word, via the curriculum the learner must be helped to situate himself in time and space for growth and survival, that is, he must see himself as part of the dynamics of a particular ecocultural spiral in relation to the surrounding competing spirals of symbol systems each vying for possession of his central nervous system--his only house of consciousness and the powerhouse on which his life depends.

The model divides the symbol systems or symboliques into two categories: the cryptosymboliques and the scriptosymboliques, more simply, the cryptos and the scriptos. The cryptos include all the implicit ecocultural codes (symbol systems, symboliques) spontaneously shaped and honed in the course of evolution and unconsciously transmitted and learned from one generation to the next; such codes as verbal and body language and the many others that are learned implicitly from birth until death. In contrast, the scriptos beginning with the invention of writing include all the explicit codes of knowledge (reading, writing, science, mathematics, etc.) consciously wrought, recorded, transmitted and learned by special groups and individuals. Derivative interdependent and interacting forms such as cryptosymboliques/scriptosymboliques, cryptocurriculum/scriptocurriculum, cryptodynamics/scriptodynamics, cryptoculture/scriptoculture, etc., within which are couched key concepts of the model serve in highlighting some of the major forces at work in inter- and intracultural dialectics. Finally, the model presents

as a fundamental postulate the preponderant influence of the cryptos in cultural continuity and historical dialectics.

Evolution

To cast more light on the symbiotic process of the inseparable triad that forms bio-ecocultural systems, it will be necessary to examine more closely the evolutionary process. Besides, such an examination will supply the necessary background for making the analogies and links between the biological and ecocultural reality that are central to this hypothesis, for example, to compare and contrast the gene pool with the symbol pool, genetic knowledge with symbolic knowledge, the biological cognitive apparatus with the ecocultural cognitive apparatus.

The universe since its birth is a boundless mass of energy in perpetual transformation whose dynamics created by chance microscopic inorganic open systems like the atom before creating organic ones like the cell and finally cultural ones like the symbol. Each in turn evolved into macroscopic open systems such as the solar systems, multicellular living organisms and sets of symbol systems, that is, cultures. The microscopic systems fit into ever increasing macroscopic systems in an irreversible process of hierarchical complexification, diversification and specialisation where everything hangs together--elements, structures, functions, systems--in an open hypersystem where everything is interdependent in constant interaction and transformation. These systems of systems of systems having a physical basis are all subject to the second law of thermodynamics leading them gradually to a maximal degree of molecular disorder or homogeneity, that is, to the end of their evolutionary process or death. The biological systems counter the inexorable increase of disorganization or (positive) entropy by a counter force, negative entropy, which restores order and organization to be forever newly challenged by the disintegrating force of entropy in a never ending cycle except at the death of the individual organism. In the case of humans, a particular cultural collectivity, that is, an ecocultural spiral can disappear without the biological death of the group.

Biological evolution is the history of life. Just as there is no knowledge without life there is no life without communication and information and there is no communication of information without codes, be they genetic or symbolic. In

its broadest sense, the curriculum, more precisely the scriptocurriculum which is made up of graphic codes, is the voluntary and conscious construction and recording of the codes of knowledge and communication postulated by man from the black box of cosmic and biological evolution. All living organisms from bacteria to man are caught up in a threefold lottery--biological, ecological and cultural. No organism chooses its genetic code, the ecological niche into which it is born nor its cultural heritage. All these are determined by chance. In contrast, the cryptocurriculum which is made up of the genetic and ecocultural codes, that is, the set of rules that govern the process of life, growth and survival of the species remains out of the awareness and control of the individual living organism. It is the specific role of the scriptocurriculum to decipher the cryptocurriculum in order to make the individual aware of the rules of the game that determine his survival as an individual and the continuity of his species, more specifically, his ecocultural spiral. This consciousness leads to a measure of understanding of and control over his personal and collective destiny; without this awareness there is a much greater probability of accelerating disorder, disorganization and death by simply being left exposed to the cruel ethics of chance built into the evolutionary process.

The laws of evolution do little to protect the weak. It is indeed a case of the survival of the fittest. As we move up on the evolutionary spiral, a slow and gradual process of emancipation from the tyranny of the genetic code takes place leading to the exceptional autonomy enjoyed by man who by virtue of the recent exponential growth of his cultural codes is increasing his powers over his physical environment, including genetic engineering. In the case of modern man, the triadic bio-ecocultural codes are no longer developing symbiotically. Cultural evolution has clearly outdistanced the biological and the ecological and both the latter are in a very real sense at the mercy of the former. With the introduction of the computer age with its highly efficient set of cognitive tools that serve as an extension of the brain, man's potential to influence his bio-ecocultural evolution has increased immeasurably.

Recent research indicates that if human universals exist they must certainly be within that mysterious black box of some fifteen hundred cubic centimeters commonly called the brain. It is, in fact, inside this black box with its ten billion interacting neurons where the action is. The history of the bio-ecocultural spiral is the evolutionary process towards increasing complexity

leading to the development of the central nervous system culminating in the hypercomplex human brain. From the first stirrings of life in the primeval soup where the miracle of cellular replication occured, the cell has been the center of activity in organizing the life process. In fact, it is at its very core, in its nucleus, in its minibrain center, that the celebrated spiral-like double-helix structure of the DNA molecule, the basic building block of organic life, monitors its reproduction and survival through complex computer-like coded information, that is, genetic knowledge. Just like computer tapes where sequences of magnetic signals encode messages of words, numbers and sounds, messages of unlimited variety and specifications are imprinted on the crystals of the double-helix sequence of certain chemical groups acting like letters of the alphabet. Sebeok, the psycholinguist, has dared compare the genetic code to the linguistic code. These messages are, in effect, the program of life. The more complex the organism, the more elaborate and detailed are the specifications in order to meet the exacting demands of cellular interdependence and coordination from bacteria to man.

If the program of life lies within the DNA molecule, it was not fixed once and for always at a particular point in time, otherwise biological evolution could not have taken place. It is an open system in that mistakes in the execution of the program produce genetic mutations which are a product of chance through minute misfunctions in the system by the introduction of noise from the immediate and/or external environment. These mutant genes were either eliminated or utilized through the process of natural selection when the environmental changes created a crisis of adaptation in the life of the species. Minor breakdowns or misdirections in the execution of the DNA program created multiple mutant genes that lay in storage in the gene pool of the species, for a rainy day as it were. Those organisms that had the right mutant genes that could come to the rescue of the species when faced with an environmental crisis were the winners in being the survivors, whereas the owners of the inappropriate-for-this-particular-crisis mutant genes were the losers. Their eventual elimination meant the transformation of the gene pool.

The genes are survival machines whose field of operation is the species. That some genes should have to die with the organisms that housed them just because they could not meet the demands of a particular ecological change is all part of the cruel game of natural selection. It is François Jacob, the French Nobel prize

winner in genetics who says that the gene's sole dream is replication. Genetic mutation is the product of chance whereas genetic reproduction is the law of necessity which maintains the continuity of life. But genes work together in organized squads as found in the genetic code and these squads operate in a highly intricate dynamics of interdependence within the multicellular organisms. The more complex the organism, the more delicate and intricate the organization and functions. The countless genes that made up the human gene pool offered almost infinite possibilities of permutations and combinations for the creation of a reserve stock of mutant genes, some of which would come to the rescue of the species by allowing some of its members to adapt through natural selection in the face of an ecological emergency.

Some biologists believe that the capacity for symbolic thought which appeared at some point in man's evolution was probably the result of certain mutant genes in the reserve stock of the gene pool that proved best adapted to meet the special environmental crisis faced by man at that particular time. As a matter of fact, some go so far as to suggest that this new rudimentary faculty for symbolic thought in language and/or gesture, with its consequent developments for the storage, retrieval, communication, transmission and creation of such symbolic knowledge launched evolution properly on the road to mankind through an unprecedented rapid growth of the central nervous system, more particularly, its central computer, the brain. In other words, out of an ecological and biological accident--the right mutant genes available at the right time to resolve a particularly grave crisis, the human ecocultural spiral was born. In effect, through a delicate process of symbiosis between mutant genes and environmental change the bio-ecocultural cognitive apparatus of modern man came into being. New genes creating more neurons added themselves to the structures of the central nervous system which henceforth would be able to perform more complex cognitive functions. This complexifying process led to the revolutionary introduction of symbolic thought, language and consciousness, each in turn making greater demands on the human organism as these new tools increased their powers of manipulation over the physical environment. In the course of time, the human ecocultural toolkit improved by virtue of the accumulated neural mutant genes that allowed for the reorganization of the central nervous system adapting itself to each new demand of the environment. This, in a word, represents the spiral-shaped symbiotic process of growth of the bio-ecocultural set of codes of knowledge and communication that constitutes the cognitive development and structure of all

living systems.

This symbiosis between the genetic and ecocultural codes established the inseparability of genetic and symbolic knowledge, that is, the inextricable link between the biological cognitive apparatus and the ecocultural cognitive apparatus, as a direct consequence of the evolutionary process. In this connection, highly pertinent is the comment of Paul D. Maclean, the well-known American neurologist, cited earlier: "I have always felt embarrassed to admit the dichotomy between the biological and the cultural." (The Unity of Man: The Human Brain, p. 137, translation mine). Furthermore, as regards the inseparable bond of the ecological with the biological and cultural, it is also pertinent once again to quote the French bio-anthropologist, Edgar Morin: "...the ecological dimension must be present in all observation and all thought, all must be ecologized, and all must be seen as meta-system and from a meta-perspective viewpoint." (The Method: The Nature of Nature, p. 379, translation and underlining mine).

It is now an established fact that the linguistic cognitive structures are lodged in specific areas of the brain. These areas are species-specific which explains why no amount of verbal communication in a natural non-experimental setting with non-human mammals triggers off automatic language learning processes. It is generally accepted that the language faculty is a biological inheritance determined in the genetic code of the human species in the course of evolution. Furthermore, it is clear that this faculty for speech cannot come to life without first being nourished by exposure to the data of a specific natural language at the appropriate stages in the brain's maturation. If a child is never exposed to the symbol system of human speech before the age of puberty, it is highly likely that he will never learn to speak. The ideal time to learn to talk is that period chosen by evolution as most favourable, roughly between birth and five years of age.

Evolution has proven to be the greatest experimenter of all time. Not being troubled with ethical problems until it introduced this dimension at some point during hominization, time was on its side for it literally had all the time in the world to combine the laws of chance and necessity in a costly process of trial and error especially for the individual organism to improve the genetic survival machine of the species. Millions and billions of individual organisms

could be sacrified for the improvement and survival of the species. Just as the structure and functions of the heart and liver improved in efficiency with complexification, so did the genetic/symbolic cognitive structures of language increase in complexity and efficiency; by the same token, so did other physical and intellectual structures evolve to improve their performance for the continuity of the species. For instance, the cognitive structures associated with facial recognition also evolved genetically to increase man's chances of survival. To sum up, it can readily be affirmed that 99% of human evolution was involved in the structuration of the bio-ecocultural cognitive apparatus, namely, the total set of cryptos. These are, as mentioned earlier, the implicit codes of knowledge inherited genetically and ecoculturally by all human beings and maturing spontaneously under normal condition--verbal and body language, religion, mythology, rituals, moral and aesthetic value systems, dance, song and art forms, etc. By comparison, the few thousand years during which the scriptos developed (all those explicit codes of knowledge formally wrought, recorded and learned with conscious effort by the few--reading and writing, mathematics and science etc.,) represent but a few seconds in an hour of evolutionary time. Ruthless as it was in its treatment of the individual organism in favour of the species, or of those species that were lost on the dead-end road of overspecialisation, evolution can be said to have shared the genetic wealth reasonably well when it comes to man's cryptos. For example, save the odd exception, all humans are genetically equipped for language learning. Chomsky's postulated universal grammar, if it exists, is evolution's greatest gift to man. Furthermore, nobody needs to learn in a conscious way how to distinguish one human face or voice from another. Individual differences in visual and aural perception do not alter the fact that almost everyone is equipped with a basic set of cognitive structures at birth, just as he inherits genetic programs for the functioning of the liver and the kidneys. Finally, it can be said that evolution has been the great benefactor, bestowing various specific networks of cognitive structures to all the existing species along with a special potential for development in the case of man to ensure optimal chances of survival with a minimum of expense in time and energy by virtue of a maximum control over life and environment. That is what man's cultural revolution is all about. Ironically, Evolution, the great benefactor, by creating Man perhaps created its Frankenstein.

Ontogeny and Phylogeny

No discussion on evolution can exclude a fundamental principle of biological development, namely, the biogenetic law formulated by Haeckel in the 19th century which states that ontogeny recapitulates phylogeny. Phylogeny relates to the history of the species throughout evolution whereas ontogeny refers to the life history of the individual organism from conception. Simply stated the biogenetic law affirms that the embryological and post-natal development of the individual reproduces in accelerated form the adult stages of the preceding species on the evolutionary scale. For example, Haeckel interpreted the gill slits of human embryos as features of ancestral adult fishes. The biogenetic law has impregnated biological history; nevertheless, it received severe assaults since its heyday. Yet others came to its rescue by bringing to it various modifications. One of these, the biologist, Stephen Jay Gould, still considers it one of the great themes of evolutionary biology. In a recent publication entitled Ontogeny and Phylogeny he asserts: "The extraordinary persistence of a belief in recapitulation of adult stages cannot be a mass delusion. It has been with us since Aristotle, and it has insinuated itself into all theories...I refuse to believe that so many of the most brilliant scientists in the history of biology consistently placed at center stage a topic of merely peripheral importance." (1977, p. 5).

By analogy with this biological principle, Piaget draws a parallel between the psychological development of the individual and the evolution of consciousness of homo sapiens. This viewpoint could lead us to believe that Piaget considers intellectual development as being intimately related with organic growth, on a par with the development of the heart or liver, for instance. Interestingly enough, as will be examined presently, one of the key points of divergence between Piagetian and Chomskyan theories rests on the degree of genetic determinism that each postulates. Piagetian constructivism grants, though reluctantly, a minimal specific genetic component in language learning whereas Chomsky posits the existence of a genetically programmed universal grammar that comes to maturity on being exposed to linguistic data, just as the heart or liver grows and functions with proper nourishment.

As just indicated, an underlying approach in the Piagetian school of thought is that the development of knowledge, more specifically the history of

mathematics and science, is not only analogous to but might even be completely isomorphic with the psychological development of the individual from birth to adulthood. If indeed psychological ontogenesis recapitulates the cognitive phylogenesis of the species, according to Piaget, such a phenomenon would lend support to his constructivist hypothesis for he believes that the neo-Darwinian evolutionist theory with its emphasis on the element of chance in applying its principles of genetic mutation and natural selection could not possibly explain such a complex phenomenon as the creation of the cognitive faculties leading to the development of science and mathematics. Piaget argues that these structures simply could not have been present in the genetic code of the first living organism. His own theory centered on the concept of the phenotype amounts to accepting the inheritance of acquired characteristics as an evolutionary law, as opposed to the neo-Darwinistic natural selection. This position was rejected in Piaget's presence by the biologists attending the Royaumont symposium held in 1975. In direct contrast, Chomsky's theory of innateness of cognitive structures, of ideas, of concepts, of logic, of number, of geometric space, etc., sees in the evolutionist theory a "biological underpinning". It explains how the cognitive genetic program given to man by evolution can be elicited through the appropriate sense data that triggers off the maturation of the built-in hardware. For Chomsky, the fact that our innate concepts match the world and design our systems of belief that make up our common sense understanding of the world makes possible the growth of knowledge in science and mathematics but only up to a point for it also indicates the limitations of scientific discovery when it comes to fathoming the deepest mysteries of the universe. This is one reason why we do not learn physics as easily as language. In other words, evolution may have been very generous to man but within limits. Chomsky asserts that the steady state of linguistic cognitive structures reached through their maturation is, in fact, equivalent to their initial state which is innate, that is, $S_0=S_S$. This is an example of the boundaries imposed by evolution.

The biogenetic law by analogy has been applied to Piagetian constructivism. One might very well ask if it can also be applied to the Chomskyan innateness theory. Throughout this paper, I apply the metaphor of the spiral to ontogenetic and phylogenetic cognitive development, hence to the Piagetian hypothesis. Could the spiral also be applicable to the Chomskyan hypothesis? Let us see.

The process of maturation of universal grammar as postulated by Chomsky, from the initial state (the inherited cognitive hardware) through the various stages of growth up to the final or steady state attained before puberty is a genetic program that maps out the process of growth from S_0 to S_s with the environment acting as a channeling agent for the exposure of the inner underlying structures much as in the development of a negative in photography. This is radically different from the Piagetian progressive trial and error constructivist view of cognitive development. The Chomskyan position consists in exposing inner structures and matching them with the environment rather than constructing structures by a trial and error exploration of the environment, as Piaget proposes. At first glance, one can see how the spiral metaphor lends itself more readily to Piagetian constructivism than to Chomskyan maturation of innate structures. However, if we examine two key factors in the Chomskyan hypothesis, the spiral concept perhaps can find relevance.

First of all, transformational grammar is a generative process of hierarchic nature based on the mathematical theory of recursive functions, that is, the theory of sub-recursive hierarchies on which rests the postulate of universal grammar with its essential categories such as structure-dependence whose rules function hierarchically but not linearly. The speech continuum may come out as linear but its organization--its creative process--is hierarchical. If the creative process of language as an intricate set of hierarchic rules of transformation is innate, by pondering its origin we are led to the second key factor to be considered. The cognitive genetic hardware that makes language acquisition possible for everybody is one of evolution's principal contributions to man in his quest for survival. It is not a sudden gift from the gods that swept down upon homo sapiens overnight. Chomsky admits to the underpinnings of biological evolution to his theory. If chance acting through genetic mutation and natural selection led man to his hypercomplex cognitive inheritance, is it not plausible to view this cumulative growth as being compressed microscopically in spiral-form as it were, within the genetic code before coming to maturation in a spiral-shaped hierarchic process? Recent findings indicate that the genetic programs affecting the brain as well as other organic growth are not in linear sequence but in networks of increasing hierarchic complexity. Let us now cast a closer look at leading cognitive theories.

Cognitive Theories

Cognitive theories present a special difficulty in that they depend on the examination of the workings of the most intricate networks of activity hidden in that mysterious black box--the human brain. One would then expect the best theorists to be those who have opened up the black box for close scrutiny and experimentation, namely, neurologists, neuroanatomists, neurobiologists and the like. As we all know, this has not prevented dozens of other specialists such as linguists, psychologists, psycholinguists, philosophers and many others from formulating their theory of mind even though they were left to unravel the mysteries of the brain largely on the basis of the examination of the input and output of the black box with varying methods of analysis and description.

At the moment, as introduced above, there are two principal schools of thought concerning the nature and learning of language and psychological development in general. They have developed independently of each other. One is European--the Piagetian constructivist theory of learning named after its founder, Jean Piaget who has been leading it for some fifty years. The other is American--the Chomskyan theory of innateness and transformational grammar named after its founder, Noam Chomsky who has been leading it for over twenty years. In 1975, a symposium was organized at Royaumont in France to debate the pros and cons of this controversy in the presence of the two leaders along with a team of internationally known specialists ranging from geneticists, mathematicians, biologists, anthropologists, psychologists, ethologists and philosophers. Out of the discussion emerged certain theories that attempted to establish a link between the two antithetical positions held by Piaget and Chomsky, a kind of biological compromise as it was termed by one of the three neurobiologists who call their hypothesis the selective stabilization of synapses in the maturation of the central nervous system.

The Chomskyan theory of language posits an innate fixed nucleus of grammatical categories that its author calls universal grammar. For Chomsky, what matters is to discover the specific nature of this genetic kernel by postulating such

universal grammatical categories as structure-dependence. He rejects the very concept of learning as misleading substituting for it the metaphor of growth and progressive maturation of the genetic hardware (structure-dependence rules and other universal linguistic cognitive structures) which is triggered off by exposure to appropriate linguistic data and other factors during the most favourable stages of psychological development, namely, from birth to puberty. As for Piaget, while he admitted reluctantly at the symposium the existence of certain specific linguistic cognitive structures at birth, his constructivist theory of learning rests essentially on the development of cognitive structures from the interplay of general intelligence with the environment. His main thesis is that through a process of self-regulation or feedback, new environmental factors constantly pressure the organism to surpass itself by increasing the complexity and efficiency of its cognitive structures the better to assimilate and reduce the noise the organism is forever subjected to. This process of intellectual growth fluctuating from a state of equilibration to one of disequilibration as new environmental noise manifests itself no doubt explains why Piaget so heartily endorses von Foerster's principle of order from noise. This principle of order from disorder which commands the process of growth no doubt also explains why Piaget was struck by the metaphor of the spiral that illustrates graphically the progressive complexifying hierarchic growth of knowledge. It should be pointed out in passing that Piaget did not himself apply the metaphor of the spiral with specific reference to his constructivist theory of learning.

Chomsky does not believe in the existence of learning theories in the traditional sense. He prefers to speak of the progressive maturation of the inherited blueprint. In this sense, his position is strongly deterministic in contrast to Piaget's thesis that the child is buffeted through a give-and-take process of interaction between environment and heredity. Chomsky posits not only the genetic specificity of language development but also believes there are other specific networks of cognitive structures that in conjunction with language help the individual to grow into possession of his systems of belief and common sense world. Piaget cannot accept the Chomskyan notion of innate ideas, i.e. that complicated cognitive structures such as the logico-mathematical categories and those of language are the result of mere evolutionary chance acting through genetic mutation and natural selection in the fight for survival. It is interesting to note in this connection how much closer Chomsky is to the sociobiologists' emphasis

on genetic determinism. In fact, what I call the cryptos, the set of symbol systems spontaneously acquired from birth, are the sum and substance of the common sense world that evolution offers through specific cognitive structures to the entire human population in its multiple ecocultural variation. The paradox of the cryptos is that while on the one hand, each ecocultural spiral they inhabit represents the highest degree of ecocultural specificity, on the other hand, their dynamics is powered by generative bio-ecocultural universals rooted in the evolutionary process.

Let us now examine the neurobiologists' compromise position. Changeux, Danchin and Courrège are a team of molecular neurobiologists who studied the neuronal networks of inferior vertebrates. They have come out with the idea that man is endowed with a "genetic pouch" whose potential of development is not strictly determined because of the impossibility of the DNA code to program the billions of possibilities in the structuration of neurosynaptic networks. Much as in language, the neurons constantly face binary choices which affect each successive choice thus influencing the shape and development of the networks. This is why they speak of neuronal plasticity. The "genetic pouch or casing" contains a set of programs that are not a fixed chart. Depending on the environmental factors that set it in motion it has many avenues of realization but must nevertheless stay within the general confines of possibilities and probabilities fixed in the genetic blueprint. Underlying this learning strategy is the contradictory notion that Changeux expresses in these words: "...according to this theory, to learn is to eliminate", a notion closely allied to that of the psycholinguist Mehler, who believes that the cognitive process is accompanied by a loss of competence since through the process of maturation the neuronal potential of the initial stage is reduced with each choice. In other words, some neurons fall by the wayside; for each choice that is made through neuronal activity other choices are automatically eliminated in the construction of neuronal micro-and macrocircuits. For Changeux et al. their hypothesis involves, from an evolutionary viewpoint, a strategy of economy on the part of the genes. They affirm that the global stock of genes has remained relatively stable in the course of the evolution of the mammals. This limited stock of genes nevertheless did not hinder the complexification of the central nervous system for the reasons explained earlier.

This biological compromise offered by the neurobiologists was accepted

enthusiastically by Piaget but not so by Chomsky. Throughout his entire argumentation Chomsky stressed that the brain was an organ much like the other vital organs of the body, the heart and the liver, for instance. By maintaining this analogy he contends that to apply the Changeux hypothesis of neuronal plasticity to the genetic programs affecting the growth of the other bodily organs would prove impossible for it is a generally accepted fact that they develop according to precise genetic programs. All cells contain the genetic code and since neurons are also cells why should we be so insistent on expecting them to behave so differently just because they handle the organ of the brain, hypercomplex as it may be. François Jacob, the geneticist, asserts that we know little or nothing about the development of physical structures. One could no doubt ask, if this is the case, why are we so quick to affirm that the genetic programs governing the liver and the heart are so much more specific than those governing cognitive growth?

In the September 1979 Scientific American special issue on the brain, Maxwell Cowan presents a point of view that would appear to lend support to Chomsky's emphasis on the specificity of cognitive structures in the following words: "Undoubtedly the most important unresolved issue in the development of the brain is the question of how neurons make specific patterns of connections. Earlier notions that most of the connectivity of the brain was functionnally selected from a randomly generated set of connections are now seen to be untenable. Most of the connections seem to be precisely established at an early stage of development, and there is much evidence that the connections formed are specific not only for particular regions of the brain but also for particular neurons (and in some cases particular parts of neurons) within these regions." ("The Development of the Brain", p. 131). In the same issue in a paper on "Specialization of the Human Brain", Norman Gershwind adds more weight to the Chomskyan language specificity argument in this comment: "If functions as narrowly defined as facial recognition are accorded specific neural networks in the brain, it seems likely that many other functions are represented in a similar way. For example, one of the major goals of child rearing is to teach a set of highly differentiated responses to emotional stimuli, such as anger and fear. The child must also be taught the appropriate responses from the internal milieu, such as hunger or fullness of the bladder or bowel. Most children learn these patterns of behavior just as they learn a language, suggesting that here too special purpose-processors may be present." (p. 199). In this connection it is

interesting to add that Wernicke's area in the left cerebral hemisphere not only plays an important specialized role in speaking and understanding the spoken word but also in reading and writing. It is one of the claims of the Piagetian school that the child is a born hypothesis maker, a competence which he practises his life long to construct his inner world. One might well ask on the basis of the preceding pronouncements on the specialization of cerebral activity, if this cognitive tool of first importance is not also a specific structure.

In the light of the foregoing cognitive theories which have been elaborated by some of the leading thinkers and researchers of the day, one can readily see how the great majority of us who are involved in curriculum construction are doing nothing more than shadow boxing around that mysterious black box that is the human brain. We offer our prescriptions diligently and conscientiously though we are enveloped in a perhaps impenetrable shroud of darkness yet we can only hope that by some miracle they will work. This miracle lies buried deep in the mysterious cryptos. Thank goodness that evolution has provided man with an excellent cryptocurriculum well honed and tested over millions of years. The age-old forces buried deep within the triune brain are the real educators, the only true authorities--the cryptodynamics that are the center of activity of the first, predominant and permanent school of man. What we must never forget is that as curriculum workers we are involved strictly in the scriptocurriculum, a very recent enterprise although thriving extremely well judging from the busy business that has grown up around it. Unfortunately, the cryptos is where the real action is and always was and no doubt will continue to be. Historical dialectics is essentially equivalent to the growth, development and activity of cryptodynamics. Because of the growing power of scriptodynamics increasing exponentially we scriptocurriculum workers tend to suffer a great delusion probably brought upon by hubris if we think we have the cryptos by the tail, so to speak. It is a vicious circle for it is only with the tools of the scriptoculture that we can begin to unravel bits and pieces of the inordinately complex dynamic structure of the cryptocurriculum. The heart of the matter lies in that perhaps unfathomable universe--the human brain--which many believe may very well be incapable of deciphering itself at this particular stage of biological evolution. Hence, we symbolicians (all workers and researchers in scriptos) may as well get used to dancing in the dark for a very long time to come. One way of relieving our anxiety in the meantime is at least to

try not to impede the free play of the cryptodynamics especially among school children and students but also among the population at large on the arrogant grounds that the new findings in scriptos always know better than the cryptos. I once knew a student in linguistics who on the basis of his recent scripto findings in the Inuit language which he learned to speak moderately well had the audacity to correct the speech patterns of his Inuit informants. Needless to say, there was a vigourous crypto reaction and for good reason for the cryptos obviously possessed all the rights of seniority and authenticity, and creativity to boot.

Universals and Variants

The establishment of the difference between universals and variants is also fundamental to our discussion. The present hypothesis is centered on the dynamics of systems of systems. Viewed within this context, universals and variants cannot be considered as mere static entities on which are attached a simple descriptive tag such as: consonants and vowels are universals because they are found in all languages but nasal vowels are not for they appear as variants only in half a dozen languages or so. Quite to the contrary, universals and variants are dynamic systems themselves. They are generative structures that create new ones in expanding hierarchic networks. The variants are an outgrowth of the universals. Generative grammar that has its roots in universal grammar is an excellent example. A basic grammatical category such as structure-dependence is a universal program in the genetic blueprint that all humans are heir to. The basic set of rules of transformation that come into play in the course of the maturation of the language faculty are universal. The rules of grammar of particular languages are systemic variants appearing at the ecocultural surface structure but generated by universal systems built into the genetic code. In other words, universal grammatical categories are programs that can generate a wide variety of natural languages.

Broadly speaking it can be affirmed that human universals are genetically determined, to wit: the language faculty, the ability to recognize faces, space and auditory perception and so on. The interlocking of the biological and ecocultural codes diachronically and synchronically within the evolutionary cognitive spiral considerably blurs the boundary line between innate and acquired characteristics.

The traditional dichotomy made between nature and nurture breaks down if one accepts the symbiotic development of the bio-ecocultural codes that constitute the history of life and knowledge. Man can no longer flatter himself with the notion that he occupies a special spiral unrelated to the evolutionary spiral. His species with its ramification of ecocultural spirals is also part and parcel of the entire evolutionary process. If genetic and symbolic knowledge intertwine historically, the line of demarcation between inherited genetic and ecocultural programs is far from distinct. Of course, the boundary line is much clearer in comparing these programs from one species to another. For all these reasons then, we can equate a certain number of biological invariants with cultural universals in contrast to the common opposition of biological universals and cultural variants.

At first flush this equation seems to contradict what was just said above about universal grammar as opposed to the particular grammars of natural languages. Wilson claims that religion is a classic example of a universal of social behaviour rooted in the genetic blueprint. Yet what comes immediately to mind is the wide variety of religions. This paradox is resolved by reintegrating nurture with nature. In this way the genetic component in religion, comparable to universal grammar, acts as a universal program that generates a wide variety of religious practice. Man's earliest ancestors shared other bio-ecocultural universals over and above innate linguistic cognitive structures, face recognition and so on. For instance, kinship rules, marriage, exogamy, myths, rites, magic, religion, art, song and dance to name only a few of the cryptos deeply imbedded in the bio-ecocultural universals which did not prevent them from generating the specificity of ecocultural variants during the diaspora. The main tenet of sociobiology is that ALL social behaviour has a biological basis, even morality and ethics which also have their ecocultural variants. If man feels so much more at home with his cryptos than his scriptos it is because his cryptos are like second nature to him, so to speak. And this for two key reasons that are in fact indivisible. First, they are deeply rooted in his genetic inheritance. Secondly, they come to maturation by virtue of his ecocultural inheritance. The net result--a set of basic cryptos, the principal toolkit that shapes his common sense world. The individual has no choice. He must accept this triple inheritance of nature, environment and nurture, willy-nilly. The inseparable union of the genetic and ecocultural programs in the common meeting ground of the central nervous system

is bound by bio-ecocultural universals. The fact that ecocultural variants exist between collectivities does not in any way diminish the strength of the bio-ecocultural bonds within the individual. This is no doubt the principal reason why human beings are ready to give their individual lives for the survival of the ecocultural "species". There is a fascinating parallel to be made, to wit: evolutionists agree that what is at stake in the evolution of the species is not the survival of the individual organism but that of the species. With man, the war of the species became a war of ecocultural "species"--the war of symboliques or symbol systems.

To sum up, the struggle for cultural survival is just as biological and therefore as inevitable as the instinct for physical survival. The theater of war is the central nervous system. No wonder culture dies hard and painfully. It is much easier to give up the ghost and many, under cultural pressures choose just that by commiting suicide. No doubt this also explains why people usually identify cultural assimilation as a gut issue. It is understandable that the metaphor of the viscera is more accessible to the popular mind than the more abstract central nervous system.

If biological cognitive universals are indeed comparable to genetic programs that generate a multiplicity of ecocultural variants one would expect the learning or maturation process to obey universal rules. Thus one would not expect different cognitive styles depending on the individual and ecocultural spiral. In this regard, it is interesting to point out that some crosscultural psychologists, John Berry et al. have investigated the cognitive style of various cultures on several continents. Their findings reveal that field dependent cultures, mostly agricultural, have a rigid and authoritarian social hierarchy where the individual enjoys a minimum of personal autonomy and initiative, whereas, field independent cultures, mostly hunting and gathering societies, have a very flexible, adaptable, non-hierarchical and non-authoritarian social structure that offers the individual a maximum of personal freedom in which he can exercise his personal inventiveness and creativity. This would tend to indicate, broadly speaking, two different approaches to the dynamics of learning. Similar studies were done by others intraculturally and between the sexes. Individual, group and sex differences were found on the basis of the same broad criteria of field dependence and independence.

If cognitive styles are indeed ecocultural systemic variants, these would be explainable in reference to the particular toolkit (set of symbol systems) with which the individuals of a given collectivity are equipped to probe reality. This would apply equally to intracultural differences in cognitive styles for each ecocultural spiral or macrospiral is made up of individual microspirals that can be further grouped as intraspirals depending on their particular differences in symbol systems. For example, a child of Black English culture is not as favourably equipped to master the scriptos based on standard American English on starting school until he learns the standard network of symboliques, not just the standard English dialect. The child possesses on the whole the same innate cognitive universals but these have matured to satisfy a different environment. Each ecocultural spiral, by definition, be it a macrospiral, microspiral or intraspiral is equipped with a cultural set of tools to survive in a particular ecological niche. Huge complex industrial societies are made up of many more different environmental niches than small hunting and gathering or agricultural social units. If the central nervous sytem is the central computer that controls behaviour it must necessarily compute with symbol systems and these are not all meant to serve the same purposes. If most people survive physically to intercultural conflict it is obvious that it is due to the cognitive universals that can generate more than one set of variants. The whole question of sound psychological growth rests on the manner, time and place the ecocultural variants come into play. Unfortunately, like the human brain, very little is known about this hypercomplex interplay between universals and variants.

Symbols and Symboliques or Symbol Systems

In the beginning was the word and the word was symbol, only in this case the beginner was not man. Buffon, the great 18th century French naturalist said somewhere: "Le symbole est le propre de l'homme", that is, the symbol is man's distinguishing characteristic. As I have tried to show throughout this paper, this magnificent all-purpose tool is not restricted to man though he is the one best equipped to make it multiply and fructify--something I perhaps practised too bountifully within this text. Indeed, the elements of the ecocultural spirals are symbols assembled into sets of interdependent and interacting symbol systems or symboliques that make up each cognitive spiral--the microspiral (the individual) and the macrospiral (the microspirals sharing the same set of symboliques). But these semiotic systems are not man's special preserve. Thomas A. Sebeok pointed out in his Animal Communication that: "It is clear that the genetic code must be regarded as the most fundamental of all semiotic networks and thus the prototype of all the other signal systems used by animals, including man." (p. 12). David Premack and the Gardners have shown in their teaching experiments with their superb

chimpanzees that symbolization in the broad sense of re-presenting one thing by another, namely, a symbol is not man's strict prerogative.

I deliberately chose the general term symbol to cover all the basic units of the numerous codes of communication shared by animal and man alike. Though symbols and symbol systems are at the very core of codes of knowledge and communication that are themselves at the heart of this hypothesis, I chose to avoid the byzantine refinements and ambiguities so prevalent among semioticians. Even where their distinctions are clear and relevant to the object of their study, it is not pertinent for my purposes here to involve the reader in the fine shades of meaning between a sign, a symbol, an icon, an index etc. This is said with all due respect to America's great semiotician, Charles S. Peirce who left behind him at his death a list of 76 different "symbols" and/or signals etc.

Within the context of this subject the important thing to keep in mind is that a given unit of sound, light, chemical component or any other unit of energy sent out by one organism can modify the behaviour of the organism or organisms that interpret the message. In this regard, I especially favour Edward O. Wilson's succinct definition of this well-nigh indefinable concept of communication: "Action on the part of one organism (or cell) that alters the probability pattern of behavior in another organism (or cell) in an adaptive fashion." (Sociobiology, p. 581). In this sense, the evolutionary spiral with its ramification into human ecocultural spirals represents one huge set of cognitive spirals whose codes and modes of communication controlled the struggle for life of the species. The word symbol is the all-embracing concept for the innumerable discrete units of communication involved in this epic venture.

If I were to give free rein to my innate powers of symbolization by virtue of the triggering effect of the spiral metaphor I might risk burying you deeper under scripto fallout than I have already done. Nevertheless, allow me to test your endurance a bit more. Each concept within a given symbolique is in fact a spiral. It has a history for it undergoes a maturation process; hence, it may be called a minispiral. A religion that spreads across a series of different macrospirals can be referred to as a supraspiral. Intracultural conflict between social classes each with their own ecocultural history and special symboliques can be termed intraspirals. Et cetera, et cetera. Then too, if we compare the gene

pool to the symbol pool, this generates another set of terms. For instance, the concept of genetic homeostasis which Wilson defines as "the automatic resistance of evolving populations to selection which proceeds at a rate fast enough to make deep inroads into genetic variability", (Sociobiology, p. 11) can easily be extended to what might be termed symbol or better, cultural homeostasis, in the sense that ecocultural spirals resist change at a rate that would risk destabilization leading to deep inroads into ecocultural variability.

Since our main concern here is homo sapiens I should like to conclude my remarks on symbols by underscoring their womb-to-tomb importance in the following quotation from the work of the French psychoanalyst, Jacques Lacan, who makes profound observations though in a rather difficult style: "In fact, symbols envelop man's life with so complete a network that they unite in marriage before he is born those who will beget him "by flesh and blood", that they present him at birth along with the gifts of the stars if not the gifts of the fairies with the shape of his destiny, that they supply the words that will make him a believer or a renegade, offer the law for actions that will follow him right up to where he has not yet arrived and even beyond his death, and that by them his end finds its meaning in the last judgment where speech absolves his being or condemns him..." (Writings, p. 279, translation mine).

Cryptos and Scriptos

Cryptos can be equated with the unconscious with oral language--the key crypto--serving as a lifeline to the conscious, that is, the cryptoconscious. Written language gave birth to the scriptos which built the scriptoconscious. The crypto- and scriptoconscious represent two types of awareness or two different categories of knowledge and communication with very different impacts on the individual, his collectivity and the world at large. The cryptoconscious in its typical form operates through oral language in a common sense world untouched by scriptos, but the world is full of cryptospirals that fight a daily battle for a modus vivendi with scriptospirals. All those caught up in the scriptospiral have broken the boundaries of time and space thus freeing themselves from the

limitations of life in the here and now. By the same token, scriptos have projected man simultaneously in the past and future with a mission to unravel the tangled skein of history and design the web of his future. This is indeed a gigantic enterprise but fortunately "The genes hold culture on a leash."

Up to the arrival of the scriptos some 5000 years ago, biological memory had grown very slowly over millions of years, let us say, in arithmetic progression. With the written text, a new memory gradually imposed itself in the leaps and bounds of geometric progression until it reached its explosive exponential growth with the introduction of the computer age. The scriptos eventually dislocated the symbiotic development of the bio-ecocultural cryptos. The cultural codes outdistanced the biological and ecological. Today the scriptos are weighing heavier and heavier on the mind of man even though contrary to cryptosymboliques that inhabit the mind the scriptosymboliques are outsiders who live out in books and tapes, that is, in paper and electronic memory. The reason the loss of one's cryptos is a kind of death is that it is comparable to losing one's memory, one's only link with the past on which rests the present and the future is built. In a very real sense, cryptos and the contents of biological memory are one and the same thing. The cryptos were there first whereas the scriptos sit but uneasily and flimsily on top of them. A philosopher, Martin Heidegger, and a poet, T.S. Eliot, each in their own way illuminate the inseparability of cryptos and human memory. The philosopher says: "qu'on se dépayse dans ses origines", in other words, since change is the inevitable condition of man let it occur from within one's roots, or if you wish, let change occur intraspirally. The poet expresses himself in these words:

Time present and time past
Are both present in time future,
And time future contained in time past.

These two reflections on human development strongly suggest that change may very well be an illusion and that we only become what we are. This is an intriguing idea in the light of the Chomskyan theory of the innateness of ideas and cognitive programs. Poets and philosophers often have a way of capturing the quintessence of things. Especially, the poet's language acting as the condensed code of science frequently reveals its essence. Is the poet not the scientist of the cryptos? Is he not deserving of the same respect enjoyed by the scriptosymbolicians?

The natural tendency of scriptospirals is to evolve towards the

universalization and standardization of its symboliques as well exemplified in mathematics and science especially. This is a movement in direct contrast to the high specificity of the cryptosymboliques. Scriptocultures are moved by a centrifugal force against the centripetal force of cryptocultures (oral cultures) everywhere especially those in their very midst. Gigantic scientific and industrial societies such as the USSR and the USA are literally swarming on their own territory with different cryptos whose centripetal force is strongly resisting the overwhelming centrifugal force of the scriptos. Yet the cryptos have the hard-headed genes on their side with their long training at survival. Furthermore, they are accompanied by powerful allies rooted deep in the central nervous system, namely, the intractable old reptilian brain driven by sex, hunger, fear and aggression and his younger hardly more tamable team mate--the lower mammalian brain which can at least be credited with being able to solve a few problems on the basis of immediate experience. For all its prowess and high feats the neocortex faces stubborn enemies in his two well-established predecessors. The rub is that three brains within a brain that grew hierarchically now sit literally one on top of the other with very poor co-ordination among themselves. The neocortex has the very exacting task of teaching his two lugheaded brothers how to talk. In fact, they possess their own language but it is genetically coded. It is really a question of the transferability of codes, from genetic to symbolic. No wonder that even the bloodiest revolutions don't affect them much. Indeed, like the cryptos rooted in them, they have deeply ingrained habits that confound the best laid plans of the most zealous scripto revolutionary. Culture dies hard! Customs die hard! Cryptos die hard! There is a modern French philosopher who predicted that the only force that can eventually crack the USSR monolith and its empire is nationalism, the driving force of ecocultural spirals on which subject more will be said in the next section.

In a very real sense the scriptos can be personified as the great intruders and manipulators of the cryptos. They have, however, a few redeeming features. They are without a doubt the only toolkit that can fathom to a significant degree the secrets of cryptos and work out additional and refined codes of knowledge and ethics for the betterment of the individual and the species. In other words, the scriptoconscious serves at once as a veritable micro- and macroscope in the probings of the cryptos and the ecosystem. The scriptoconscious stands over the cryptoconscious as a higher form of consciousness.

A final word of caution should be pronounced in regard to these recent invaders of the cryptos. The exponential growth of the scriptos with its computer memories and programs and its torrents of printed matter daily disgorged upon the planet has created a mental blockage among the population at large which is especially evident in the classroom but even more so in the cluttered busy backrooms of the scriptocurricular enterprise. There is so much to choose from and the arsenals so difficult of access and comprehension that it leads to total confusion. Let us look at one shocking but characteristic example of the burden of scriptos which is enough to make the new brain of the mathematicians howl to say nothing of the old brain's groans. The following passage is taken from Stanislaw Ulam's Adventures of a Mathematician (1975): "...how many theorems are published yearly in mathematical journals...two hundred thousand theorems a year...Clearly the danger is that mathematics itself will suffer the fate of splitting into different separate sciences, into many independent disciplines tenuously connected...for if the number of theorems is larger than one can possibly survey, who can be trusted to judge what is "important"? The problem becomes one of record keeping, of storage and retrieval of the results obtained." (Encounter, June 1977, p. 23). This is to say nothing of the fallout of this knowledge explosion on all the other interdependent disciplines. Just try to imagine the mountains of paper proliferated at the present convention. Just think of the agony of sifting through them to find a few tasty and nourishing morcels. May I apologize in passing for my own somewhat too indigestible little mound. What is happening increasingly in the face of this scripto inundation invading from all sides is that the brain just simply tunes off for fear of drowning. This mounting tidal flood is especially astonishing in the light of the fact that scriptos represent but an infinitesimal fraction of the history of man in contrast with his cryptos that lie shrouded in the mists of evolutionary time.

Implications and Applications of the Model

The opening paragraph of this paper states two objectives that are to be met by the epistemological model presented herein. The first concerns Amerindian cultures; the second all cultural collectivities in conflict. In the modern world few cultures are allowed to live in total autonomy; perhaps this was always true to

a large extent throughout the evolution of human cultures. The symbiotic relationship that exists within each individual set of ecocultural symboliques by virtue of their origin in the evolutionary spiral did not automatically vanish as a process of growth as the ecocultural spirals slowly grew apart to gain a greater degree of autonomy in their relative ecological isolation. The bio-ecocultural universals forged during hominization did not wither away with the ecocultural ramification of homo sapiens; besides, a tremendous cross-fertilization resulted from tribal conflict, war, subjugation and cultural assimilation among the innumerable collectivities. Might was right as it is still a fundamental law of life today even though we flatter ourselves with the olympian ethics of universal brotherhood. Be that as it may, it is no doubt better to have an ethical system that is only partially lived up to than not to have one at all.

The individual members of cultural communities in contact, by becoming aware of the unseen forces at work in cultural continuity and discontinuity can bring about certain changes and agreements that can enhance the chances of survival of the more fragile cultural groups. In effect, the war of cognitive spirals in contact is always a hot war; awareness of the cross-cultural dynamics is a way of cooling it. In desperation, some of the most threatened cultures would seek peace of mind in the total autonomy of total isolation. This is a practical impossibility for few are so favoured by geographical isolation as to remain inaccessible to foreign symboliques. The image of the global village comes readily to mind. The model then cannot possibly serve as a miracle cure against the destabilizing forces wrought on the individual or group caught up unwillingly in the wrong camp of intercultural conflict. At best it can serve as a broad chart within which the individual microspirals and macrospirals can situate themselves in relation to the others to achieve by personal and group effort a relative peace which, in point of fact, at best will be a cold war. The terror of the cold war is that you must forever be on your guard, perpetually on the <u>qui vive</u>, through conscious effort which is exactly the opposite of the relative ease enjoyed by those stronger cultures whose cryptocurriculum can function and develop spontaneously and relatively painlessly. In all sociodynamics this is the privilege of the majority while the minority must forever remain on the alert. Some would say that is indeed the law of life but as we know it is also the law of death. Evolution had no conscience. Its only law was the survival of the fittest no matter the price. Man, a product of evolution, inherited conscience with the

neocortex which pursues indomitably its ancient struggle against the blind forces hidden deep in the reptilian and lower mammalian brains. Therein lies the challenge to discover "... transcendental goals toward which societies can organize their energies. Those goals, the true moral equivalents of war..." that the sociobiologist, Wilson, proclaims in his latest book On Human Nature. He adds significantly: "In order to search for a new morality based upon a more truthful definition of man, it is necessary to look inward, to dissect the machinery of the mind and to retrace its evolutionary history." (p. 4). It is in the study of the evolutionary epic, that sociobiology--the new synthesis of social and biological sciences--will find "...the ethical premises inherent in man's biological nature." (p. 5). That is the new science of bioethics proposed by Wilson. The crucial point is to be able to perceive where we come from, why we are what we are, where we are in relation to each other and where we want to go. We must also acknowledge that in the main we are not responsible for our individual or collective cryptos that we all inherit willy-nilly at birth. On the basis of this stark realization, we can then try to discover through study to what degree we can consciously affect and alter our individual and collective destiny. When all is quiet on the war front which is almost never the case even for the most powerful macrospirals we can at least hope for a relative détente. In fact, in the war of symboliques left to itself there is no such thing as détente. Ethics is about all there is left to achieve some decent modus vivendi among the multifarious spirals that share this planet.

Let us now examine a very concrete application of the model in regard to Amerindian oral cultures which by definition are cryptocultures. The problem is the following: the members of a given cryptoculture need to decide whether the devising of a writing system which implies the construction of a scriptocurriculum and the training of teachers to transmit it via the school is likely to enhance their chances of cultural continuity or not. If they use as a model the practices of the majority culture whose dynamics is overpoweringly influential on theirs, at first glance it would seem that to imitate the tools of the adversary might well be one of the most effective ways of counteracting undue pressures from the foreign set of symbol systems. This decision is in fact the one many Amerindian cultures have taken with varying results which to my mind have been beneficial mostly for

its psychological effects. The advantage of a scriptocurriculum and/or scriptodynamics over a cryptocurriculum and/or cryptodynamics is that the former are the fruit of conscious effort, tend to be more concrete, visible and tangible whereas the latter are subtle and largely unseen, that is, out of awareness, and taken for granted. If one examines the question in the light of the model I have presented here, the benefits of a native school system with all that it implies may be more apparent than real. Let me explain.

The model shows the preponderant importance of the cryptos throughout hominization. The scriptos are very late comers indeed and even today are involved in the direct personal development of only a minority of humans. Even those who are immediately affected by attending school are first shaped by the cryptos. The central nervous system of all humans is first impregnated with the cryptosymboliques of their immediate environment. People live out their life essentially in the common sense world dominated by the cryptos. Ordinary language, common sense beliefs and values, common perception of time and space etc., constitute 99% of the psychodynamics of 99% of the population. This is a fact of life even in the most literate societies. The old saying that culture dies hard is based on the common sense perception that what is so deeply lodged in the central nervous system from birth cannot be removed by a magic potion even if it is advertised on television. Yes, the cryptos die hard just as the scriptos are hard to inculcate. Once the cryptos are lost there is no coming back. This is the tragedy that occurred to the Hurons of Quebec. They are a few thousand people living on a small reserve near Quebec City which still serves them as an ecological niche in a purely spatial sense with but a few vestiges of a once proud culture. Genetically there are still some obvious traces of Indianness though intermarriage has considerably altered even their physical appearance. Their language is dead. Their way of life resembles that of any other suburban group yet there is a strong nostalgia for the past and a conscious desire to retain whatever ethnic identity is left. The chief wears a traditional long tail of braided hair; a young musician composes songs in a "mother" language he has never heard from an old dictionary; a mother of several children asks me in tragic seriousness if it might not be possible to bring back their language to life from the corpus of a dictionary and grammar. It is clear that the cryptodynamics of this group is beyond the point of no return. The Huron ecocultural spiral has come apart, even the gene pool has

been radically transformed. The most dynamic Amerindian ecocultural spirals in Quebec, for example, are those that are still isolated geographically and are regaining their autonomy, the Crees of Hudson Bay, the Montagnais of the North Shore of the St.Lawrence and of course, the Inuit of New Quebec.

To come back to our original question: should these native populations imitate the majority culture with a complicated scriptocurriculum in their respective languages? Most of them have already started on this road with obvious psychological benefits. The model indicates that this new venture into native education in a formal sense within the schoolroom should not become a dangerous illusion where many of the most talented people of relatively small communities should be occupied in a task that is not the most important to save their cryptos. The scriptos must be a natural outgrowth from the cryptos to have any worthwhile effect. This takes time, energy and money, but mostly time, which unfortunately is running out, not to mention dwindling numbers. So the main message from the model to the oral cultures is: with limited time and hands, do not put too many eggs in the scripto basket, you must save the hens that lay the eggs--the cryptos. How to do this is no easy matter but cannot fall within the narrow confines of this paper. The model is meant as a main chart to orient vital choices. Nevertheless, the model can be specific enough to enable one to recommend and draw up a plan for a native culture to learn the language of the surrounding majority culture for purely basic practical intercultural communication under conditions where the influence of the foreign cryptos is reduced to the minimum.

To give an example of the practical application of the model on non-Amerindian cultures there is the ancient conflict between the French and the English in Canada. Let us imagine the Minister of Immigration of Quebec, either in its present political status as a province or as an independent country, facing the decision of massive immigration. For the sake of the argument, let us say a million people in ten years, roughly 20% of the present population keeping in mind that 20% of the present population of Quebec is non-French and is concentrated in the metropolis of Montreal. The Minister with the help of his technocrats feels quite confident that he has satisfied the desire of his 80% French majority for cultural continuity on announcing this massive immigration because he has respected

the sacrosanct criterion of language, namely, that all immigrants be able to speak French on arrival. Some 300,000 are expected from Asia, mostly from Vietnam and Cambodia, another 300,000 from French-speaking Black Africa, 200,000 from the Arab world, 100,000 from Europe, mostly from France, Belgium and Switzerland, and the remaining 100,000 from Haiti and North and South America. According to the model, this policy would mean at best radical destabilization of the process of cultural continuity of French Quebec. The French-Quebec ecocultural spiral is already in competition with the Anglo-Quebec spiral which is but an extension of the Anglo-Canadian one, not to mention the Anglo-American spiral on its southern border. Furthermore, for the French spiral to be able to assimilate painlessly the pot-pourri of cryptos listed above within a reasonable time is impossible; it would take generations but the process would have radically transformed the host spiral in the meantime and even created major disturbances within its dynamics. The point to underline is that contrary to popular opinion, it is not because one speaks the host language that one is easily assimilable, even if one speaks it well. The cryptos are die-hards. French-speaking Quebec would do well to take note of the dangers of such a delusion which is comparable but even more serious than the Amerindian delusion on the power of the native scriptos for cultural survival precisely because it concerns the vital cryptos. In the Quebec example, I have omitted the additional problem of mixing the gene pool radically with Asians, Africans, Arabs and so on. Genetically determined physical features such as skin colour, shape of eyes and hair texture have something to do with self-identity. Genes, when manifest as in distinct racial features, like verbal and other symbols, form part of the symbol systems of the inherited cryptos. The United States of America are in a very good position to assess such matters.

As a matter of fact, there would be some very intriguing problems to pose about the so-called American melting pot in relation to this model. It is easier to melt gold and iron ore than to melt down the central nervous system, or to mix radically different gene pools for that matter. It would be fascinating if one could find a mathematical formula that could calculate the rate of change of cryptos given certain particular variables. At present, the Hispanic phenomenon in the U.S. is the one that is most closely comparable to the Quebec question in Canada. Suffice to say that in spite of the varied cryptos of the Spanish-speaking people of America, they still have more in common than what they

share with the rest of the Americans. The dynamics of the Hispanic spiral in California is strong by virtue of numbers and history. Present trends suggest an increased affirmation of this cultural group in that state by virtue of population growth and a new self-awareness which is contrary to the whole concept of assimilation via the melting pot. The Black American phenomenon is different because of wide geographic dispersal and a considerable loss of the original cryptos, the loss of the cryptosymbolique of language being crucial. The amazing thing is that so many values and patterns of behaviour carried by the cryptos have survived so many generations without the help of a unifying language. Of course, in some ways, Black English could be considered a substitute national language for the great majority of American Negroes. It is clear that the genes that determine the typical Negroid physical features constitute a cultural code with an unmistakable message. Here again, the model could prove instructive for those occupied in Black English curriculum making.

Black English is a vehicle of oral communication for the everyday world, the common sense affective world of a people that only need to look in the mirror to establish their distinct identity from their immediate social environment. In many ways Black English is a secret code, comparable to joual the so-called disreputable street language of French Quebecers, which aside from knitting the community together excludes the non-initiates, those who are condescending, reproving and condemning. Joual, like Black English is not an inferior code reserved for the unintelligent, the backward and the social outcasts. It is understood and spoken by everybody including artists, writers, politicians, professionals and intellectuals save for the snobs and those intimidated by the scriptos who will not admit it. It is a cryptosymbolique that has the same rights and privileges in the central nervous system as the Queen's English or the French of the Academicians. As a matter of fact, Black English, joual, and all the other codes that are learned on the mother's knee have seniority rights by reason of having been first implanted in the central nervous system. They cannot simply be rooted out by any prim and proper Miss Middle Class English, French or otherwise.

The American scriptocurriculum is rooted in standard American English. Its numerous scriptosymboliques from elementary readers and spellers to advanced mathematics and science are an outgrowth of the Anglo-American spiral not the Black English one. To devise a Black English scriptocurriculum though limited in scope,

even with the best intentions might in some ways be a form of unconscious condescension on the part of Whites and of subtle colonialism on the part of the Blacks involved in the project. Let me explain. Writing, literacy and books enjoy such an overblown prestige in contemporary society that the very fact that a Black child can read and write his mother tongue and can show off his Black English books to his own people and his White fellow students no doubt fills him with pride and confidence. Trying to make Black English legitimate by investing it with the trappings of the literate majority is to risk a very short-lived gratification leading to disappointment when the child realizes that this mini-scriptocurriculum leads him nowhere in regard to his own people, nor within the entire fabric of the school and wider society dominated from beginning to end by the maxi-scriptocurriculum of the white majority. The same could be said for the Amerindians and Inuit. It would be much more significant to accept oral Black English as the legitimate code of an ecocultural spiral that has its raison d'être alongside middle class English which serves other purposes when the Black American moves out of his milieu rather than to try to give it a shaky if not false status within the schoolroom. It would be far more constructive for the educational establishment to allow Black teachers to use Black English spontaneously alongside standard American within the school and in the school yard to establish in an effective but subtle way that each code has its droit de cité.

All over the world school systems are obsessed with the idea of standardization even when they reluctantly give in by introducing such programs as Black English and bilingual education. School dynamics and scriptocurriculum construction could suffer a revolutionary change by simply admitting the following reality which the model has tried to make explicit: the central nervous system is the most complex reality in this universe; the most prominent neurobiologists admit that they have not yet found even an adequate theory to explore it; prominent thinkers wonder if in its present state of development the human brain has the capacity to fathom the intricate mysteries that lie deep within it; everyone knows little or nothing about the operation and content of his own central nervous system. How then dare we attempt transforming in any significant way this mysterious entity in hundreds and thousands of school children, not to mention our wives, husbands, children and friends especially when we know that the maturation of the cognitive structures of all these human beings is largely outside our

immediate perception and conscious control from birth? Cryptos inhabit the central nervous system in the most subtle way and leave their permanent stamp on it no matter how much the school would like to reshape it to a tidy ideal standard mould. In the light of the above, if the school wants to and needs to act as a template it should at least recognize that there are some highly resistent organs such as the central nervous system which is the epicenter of the whole educational operation. Black English, like joual are among these resilient entities, which must be accepted as an integral part of the personality. To accept them by "scriptoizing" them is the easy way out; the only sensible attitude to take is to accept them as legitimate, practical, useful and enjoyable cryptos that have their place in the sun. If the persons they inhabit have a democratic right to enter the school, so have their cryptos. These simply cannot be unplugged from the central nervous system and left behind for the school day to be replugged on getting back home after school. It is a question of rehabilitating the inevitable and ineradicable cryptos; they must regain their rights and privileges in contemporary society, especially inside the school--as they are, unadorned and unfalsified, as cryptos not scriptos. Why fight a battle that a long experience shows cannot be won? Besides, there is something truly inhuman in trying to crush and/or eradicate another human being's most dynamic source of creativity. A child is not at his creative best in Miss Middle Class English or French which after all is only just another dialect with the added disadvantage that it is superimposed and not at all securely rooted in the central nervous system. There is no harm in its being learned, in fact, it is necessary, as long as it knows its place. It must not be obsessed with the ignorant arrogance of thinking that it can and must throw out the first inhabitant, the native language, before settling down to run the whole show on its own. It must learn to co-exist as an equal, with different duties and privileges at different times and places.

There are other implications and applications of the model which might be briefly alluded to. For instance, the concept of nationalism is transformed for the model gives it a new meaning. The individual who automatically wants to perpetuate himself and his values through his native culture is legitimately and unconsciously obeying a universal law of bio-ecocultural survival. If the pressures from a neighbouring ecocultural spiral become threatening to the continuity of the individual and his collectivity, it is the power house of human activity that is under attack--the bio-ecocultural central nervous system;

therefore, the defensive/aggressive response is to be expected. In that sense, nationalism is as old as the evolutionary spiral. Other species also fight for their territorial rights, for a place to breathe and breed. It is in this same sense that the Inuit of the Arctic have always been nationalistic without knowing it, without even having a word for it. Nationalism is an unconscious natural process built into the cryptodynamics alongside many other forces.

Then too, one's personal vocabulary can be modified by the very acceptance of the triple lottery--biological, ecological and cultural--where the individual realizes that he has had precious little to do with the basic structuration of his personality. A whole series of complexes and notions that form part of his crypto and scripto education carry less weight. Words like guilt, courage, will, intelligence, universal, different, unique, separate, language, culture, personality, education to name but a handful of concepts that are viewed differently. Should a person rightfully feel <u>guilty</u> for speaking his mother tongue, for living across the tracks or for being black, yellow or white? Should he find gratification in showing the <u>will</u> and the <u>courage</u> to transform his native speech patterns or in trying to be more <u>unique</u> than he already is? Furthermore, <u>education</u> in its popular sense is equated with the school, that is, with the scriptos. Yet the model clearly indicates that the cryptos are deeply rooted in the bio-ecocultural inheritance of the individual from birth. Besides, the cryptos leave the most permanent and indelible stamp on the psychodynamics of the organism. Hence, the cryptocurriculum, old as the hills and honed since time immemorial is the educator par excellence. Any modern scriptocurriculum that does not heed this fact is bound to be dancing in the dark around the only focus of its attention--the central nervous system of the school children and students.

Let us now examine how the model could modify the elementary school scriptocurriculum, not to mention the consequences that would inevitably ensue at all the other levels. By accepting the evolutionary epic as probably the best myth we will ever have on which to base scientific materialism, as Wilson suggests, it does not imply that a belief in a personal moral God will disappear. Wilson proposes the following: "I am suggesting a modification of scientific humanism through the recognition that the mental processes of religious belief--consecration

of personal and group identity, attention to charismatic leaders, mythopoeism, and others--represent programmed predispositions whose self-sufficient components were incorporated into the neural apparatus of the brain by thousands of generations of genetic evolution. As such they are powerful, ineradicable, and at the center of human social existence. They are also structured to a degree not previously appreciated by most philosophers. I suggest that scientific materialism must accomodate them on two levels: as a scientific puzzle of great complexity and interest, and as a source of energies that can be shifted in new directions when scientific materialism itself is accepted as the more powerful mythology." (On Human Nature, pp. 206-7).

In other words, the mind becomes the hero of the evolutionary epic. It is by discovering its nature, origin and development that man can find a solution to the problem of where he is going and apply knowledge, intelligence and will to trace the road he is to take in the future. From this evolutionary point of view there is necessarily a breakdown of the traditional gap between nature and nurture which suggests just as necessary a rapprochement between the biological and social sciences. This means that man can no longer stand on a pedestal apart from his evolutionary ancestry. The history of his cognitive powers is inextricably connected with those generations and species from whence he comes. If educators and curriculum workers accept to come down from such a pedestal, the repercussions on the scriptocurriculum are revolutionary. Wilson suggests that scientific materialism must not fight against religion by denying its existence on the grounds that God is not immediately demonstrable, rather it must explain its pervading reality. In the same way, a new scriptocurriculum oriented on bridging the gap between nature and nurture must accept nature as an inextricable dimension of nurture. For example, it means teaching religion as a bio-ecocultural reality which must be respected as such thus robbing it of its SUPERnatural authority. Just try to imagine how profoundly this would transform the metaphorical language of the simplest elementary school reader to say nothing of the courses on religion and ethics throughout the entire school system and society itself. No doubt such revolutionary changes explain why Wilson's sociobiological thesis has so profoundly shaken all the pillars of academic authority beginning with the philosophers and ethicists right down or up to some of his peers.

Last but not least, the model should if not in its widest sense which is beyond the scope of this paper, help in the interpretation of the dialectics of history. I should like to give an example which comes close to home. A little earlier I raised the hypothetical question of a particular future immigration policy and its probable results on Quebec society. Now I should like to examine a portion of Canadian history in the light of the same model.

English-Canadians are in state of general confusion over their cultural identity especially since Quebec has begun affirming hers. Government task forces, symposia, research groups and ordinary mortals always come to the same conclusion: Canadian identity is diversity without realizing the contradiction in terms. Yet in the same breath these students of the national pulse admit that French Quebecers are along with the Inuit and Indian peoples the only ones with a strong and definite sense of identity. These groups all share the fact that they are minorities if viewed within the territorial context of Canada ranging from sea to sea and to the North Pole, (usually painted pink on the maps). Each represents an ecocultural spiral with ancient roots, thousands of years for the native peoples and about 400 for the French. The English-Canadian population dates back a little over 200 years and has increased largely through massive waves of immigration, the most recent and most concentrated one since the last war. Very few of these immigrants were drawn to the native or French spirals for integration because Canada for the past two centuries has been dominated by the Anglo-Canadian spiral, and still is. If the immigrants wanted to get anywhere they instinctively knew within which spiral to be integrated. This even happened in Quebec where the Anglo-Quebec population was a distinct minority but a powerful one by virtue of being but a natural extension of the main spiral spreading throughout Canada, and one might add, the United States. For it is truly part of the Anglo-Canadian dilemma of not being able to distinguish themselves too clearly from the Anglo-American spiral.

A dissection of the Anglo-Quebec spiral shows it is a rough replica of what happened throughout the rest of the country with few exceptions like Newfoundland which only joined Confederation in 1949 and was protected by its geographical isolation and inveterate poverty from a massive flow of immigrants. Out of the 20% non-French population of Quebec, only one third has English cryptos, that is, the original settlers, the United Empire Loyalists that fled the United States at the time of the Revolution and the British immigrants that have arrived

since. The remaining two-thirds that have gone to English schools and integrated into English-run industry and commerce are mostly of Italian and Greek origin with a sprinkling of other non-French Europeans, some Indians, Pakistanis, American Negroes, and Blacks from the West Indies. While most of these non-English people speak English in a wide range of proficiency, this is about their only real link with the traditional English society. The Italians congregate in their own section of Montreal, so do the Greeks, the Portuguese and other ethnic groups as well, depending on their numbers. The cryptodynamics of these groups is, of course, localized in these areas with a certain vitality depending on numbers but eventually is doomed to slowly disappear. Cryptos die hard even if they have no future. The fact of the matter is, that since French Quebec has begun affirming its nationalism especially since the election of the independentist Parti Québécois in the fall of 1976 proclaiming in all directions its ancient motto Je me souviens--I remember-- (highly appropriate in the light of the model and our earlier definition of nationalism), the 20% English-speaking population of Quebec concentrated in the metropolis has joined hands against the affirmation of the French spiral. Yet, it is clear that they share really very little in common except a tenuous bond of English language. Italian cryptos remain largely Italian cryptos, so are the Greek ones quite Greek, and the English ones are certainly not less English. The net result is that the so-called Anglo-Quebec spiral is badly fragmented where it counts, at the cryptodynamic level. In point of fact it is a pseudo-Anglo spiral. This situation is almost a perfect mirror image for the rest of English-Canada with few exceptions. Toronto with its two million population now has a majority of non-English cryptos. Racial violence has been growing in that city in the last ten years especially against the most obvious minority groups, the Blacks and Pakistanis. According to the model, this is a reaction to be expected when a group no longer feels securely in charge in its traditional territory. The unconscious speaks in manifold ways. Sometimes it ends up in just plain old murder by pushing the alien onto the subway tracks before an incoming car to the accompaniment of the usual verbal vilifications against the victim.

In the light of the above cursory analysis, it is perhaps easier to understand why English-speaking Canadians are puzzled in the affirmation of their identity since at least one half of them have non-English cryptos assimilated to such varying degrees that the resulting mixture is indeterminate and ambiguous. The algebra of the cryptos, like the unconscious, knows only simple equations.

They do not live well with ambiguity and uncertainty. Since cultural identity is essentially determined by a distinct set of cryptosymboliques whose dynamics assures cultural continuity for the individual and the collectivity, a highly fragmented network of cryptos strains the cohesive powers of the dominant spiral. Hence the contradictory definition that Canadian identity is diversity. There follows the meaningless corollary: world identity is diversity.

A Toronto political analyst created the following intriguing neologism--mappism--to explain the only criteria on which English-speaking Canadians seem to agree in their frantic search for cultural identity. It is a geographic concept based on the territory that is encompassed by the name Canada that every Canadian child has learned in school, painted in bright pink in his geography book. From the scripto it seeps into the unconscious, but as Rotstein says, it will take more than pink mappism to forge a Canadian identity.

At this point I should like to attempt a translation into the terms of the model of a famous text in Canadian history, namely, the profound insight of the Durham Report (1839) on the political situation in Lower and Upper Canada (modern Quebec and Ontario) following the Rebellion of 1837 which led to the hanging of a score of French-Canadians on the order of the English Governor of the day. Lord Durham, appointed by the British government to investigate the matter in Lower Canada sums up the situation as follows: "I expected to find a contest between a government and a people: I found two nations warring in the bosom of a single state: I found a struggle not of principle, but of races; and I perceived that it would be idle to attempt any amelioration of laws or institutions until we could first succeed in terminating the deadly animosity that now separates the inhabitants of Lower Canada into the hostile division of French and English." It is evident that the "two nations warring in the bosom of a single state" are the French and English ecocultural spirals at war on the same territory--the Quebec of the day. This is not a mere quarrel over the principle of representation by population, a family quarrel as it were; rather it involves the whole question of interspiral dialectics ("races"). Each spiral with its own set of crypto- and scriptosymboliques, its own toolkit, its own internal dynamics, wants to assure its continuity by obeying the central law of spiral dynamics, usually called nationalism, which might be formulated as follows: I remember my past in order to be able to remember my future. The Quebec motto--Je me souviens--I

remember--translates this law of continuity most appropriately. When Durham adds "that it would be idle to attempt the amelioration of laws or institutions" he unwittingly admits that such laws and institutions are usually an outgrowth of the dynamics of each spiral and to be effective they cannot simply be superimposed against the common will. He concludes his observations by saying that any improvement in the legal and institutional superstructure leading to the common destiny of the French and English spirals can only be undertaken after the war of symboliques is over, that is, by "terminating the deadly animosity that now separates the inhabitants of Lower Canada". True to form, the war of symboliques not only continued but increased in intensity carrying the two conflicting spirals to the present crisis. Had Durham fully understood his profound sociopolitical insight he might not have gone on to recommend the political union of Upper and Lower Canada where the English could then rule as a majority according to the new representative system of government, nor would he have brutally banned the use of French from Parliament. Historians, notably French ones, point out that it is precisely because he did fully realize the seriousness of the dilemma that he acted in conformity with the colonialist mind of the day by trying to set in motion the absorption of the French spiral into the English one, hence "terminating the deadly animosity", without success as history shows.

The world is made up of a wide variety of ecocultural spirals differing in power and influence. A large number of them are doomed to a long painful slow disappearance. Why painful? Ask any immigrant. He can tell you from an abrupt and traumatic first hand experience. The fact of the matter is that if as the model shows, cultural identity is rooted in the central nervous system, this hypercomplex delicate and vital organ cannot be dismantled overnight without danger of shock for the organism it commands. By the same token, if the rate of change progresses too quickly both the individual and collective organisms--the micro- and macrospirals face a crisis. If the invasion is due to symbol systems that insinuate themselves subtly into your home territory the experience may be painful enough, depending on the dosage, but if you are physically unrooted from your ecological niche as many Amerindians among others have been, the result can be disastrous in terms of human happiness. When it does not just simply lead to the destabilization of the personality through cultural wear and tear--a kind of slow cultural genocide, it frequently ends up in sudden suicide. In small doses, it is clear that foreign influence is not only healthy but necessary. A good motto to adopt in intra- and intercultural relations might very well be: Please spare my central nervous system since you understand it no better than I do!

Conclusion

Had I taken Heinz von Foerster at his word in the following provocative statement: "The nervous activity of an organism cannot be shared by another organism. This, in fact, suggests that nothing is (nor can be) 'communicated'." (The Human Brain, p. 151), I no doubt would have spared both your central nervous system and mine by considering it pointless to write this paper. This comment of Foerster's is a stern reminder of the cry of both the poet and scientist on the veritable incommunicability of knowledge. Nevertheless, everybody is caught up in the frantic dance in the dark and we all go on observing the ritual religiously come what may. In this regard, body language is a much more reliable medium than verbal language.

Aside from the basic difficulty in the normal exchange of ideas I fully realize that with this hypothesis I took a bold plunge into uncharted waters by presenting to boot a set of neologisms that can in themselves further complicate the matter of communication. However, it is hoped that this exercise was not in vain for as John Dewey pointed out in Art as Experience, the nature of creativity is fruitfully to re-order, re-arrange, re-organize perceptions, experiences and ideas into new shapes and modes and consciousness. (Encounter, June 1977, p. 25). I insist on making perfectly clear that the metaphor of the spiral projected as the central figure of my hypothesis is not meant as a magic master key that can unlock the deepest secrets of the universe. It is offered merely as another useful tool--like all symbols and concepts--that embody a collection of apparently incoherent and contradictory data into more comprehensive form. The spiral attempts to tie together a vast network of symbol systems that govern our individual and collective lives. It is intended to give a more coherent structure to the multiple conflicting and paradoxical forces at work in the hypercomplex world of the mind and its co-extensive counterpart--the universe.

A central preoccupation throughout this discussion can be summarized in a well-worn cliché--human happiness, or in the words of the model: the achievement by the living organism of a steady state of mind through a spiral-shaped process of maturation of largely innate cognitive programs via successive states of equilibration/disequilibration whereby the psychodynamics of the individual

microspiral attains a relative harmony with and within the cryptodynamics of the macrospiral assuring him life, liberty and the pursuit of continuity, in the full realization that his personality structure is essentially the outcome of chance--the triple bio-ecocultural lottery, and finally, in his acceptance of the inexorable action of the second law of thermodynamics that pervades the universe. All gentle humour aside, let us ponder seriously the following comments by a psychiatrist, Jurgen Ruesch: "...mental disease is intimately associated with disturbances in sign behavior, language, and communication....disturbances in nonverbal sign behavior, language, and communication are associated with more severe and often longer lasting mental and nervous conditions, while disturbances in verbal sign behavior, language, and communication are associated with less severe psychiatric conditions." (Communication and Culture, "Nonverbal Language and Therapy", p. 209). This is an eloquent reminder of the intricate, delicate and profound nature of the cryptos whose lifeline is verbal language. These two principles of symbolization--the analogic, i.e. the cryptos, and the digital, i.e. that very special cryptosymbolique that is verbal language must operate in harmony to ensure the relative stability and equilibrium of the individual psychodynamics. Once again, we are reminded that symbols, symbol systems and their natural habitat--the central nervous system, are the prime players in the drama of human life, even though we are but dice in the hands of chance. Not entirely, for the scriptos are there as a possible escape hatch although they often hang over us like a threatening hatchet.

One last remark bears repeating, a point fundamental to the understanding of historical dialectics or if you prefer, of intra- and intercultural dynamics, to wit: if individuals and collectivities are willing to fight unto death for their cultural survival it is because it is a struggle as grippingly biological as it is ecocultural. That is what the war of symboliques is all about. Or should I have said that is what the war of genes is all about? In fact, they are inseparable allies fighting the same war. Then what about the environment? It is the theater of war without which there is no life, no knowledge, no war!

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